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(54) **MEDIA TREATMENT APPARATUS**

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B41J 23/08 (2006.01)

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CPC ***B41J 11/0015*** (2013.01); ***B41J 23/08*** (2013.01)

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CPC B41J 2/15; B41J 11/0015; B41J 23/08; B41J 23/005
USPC 347/9
See application file for complete search history.

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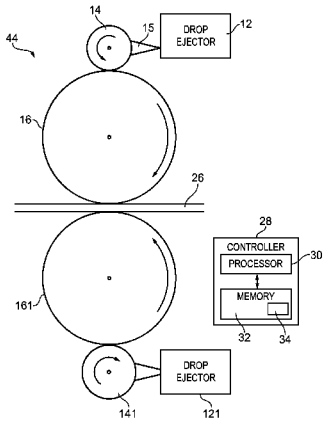
(57) **ABSTRACT**

Media treatment apparatus to apply liquid treatment to media, the media treatment apparatus including a roller to receive liquid treatment and to transfer the liquid treatment, and a drop ejector to apply liquid treatment to the roller to transfer liquid treatment to an object.

19 Claims, 5 Drawing Sheets



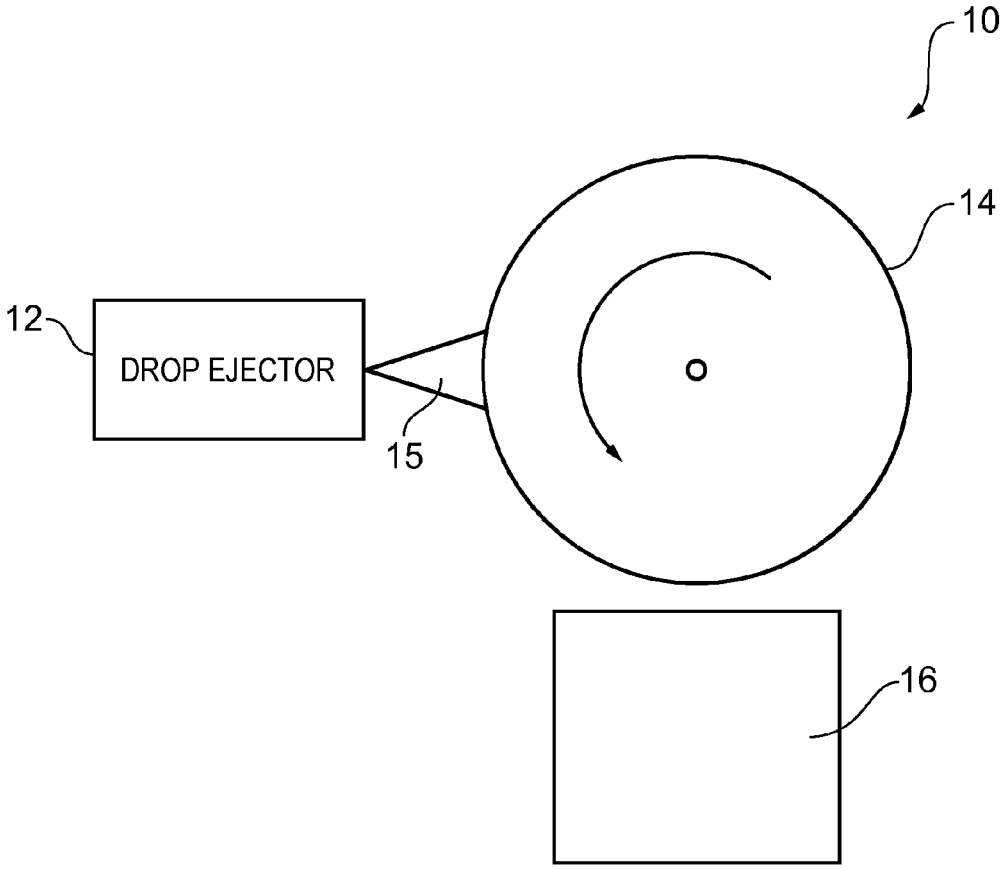


FIG. 1

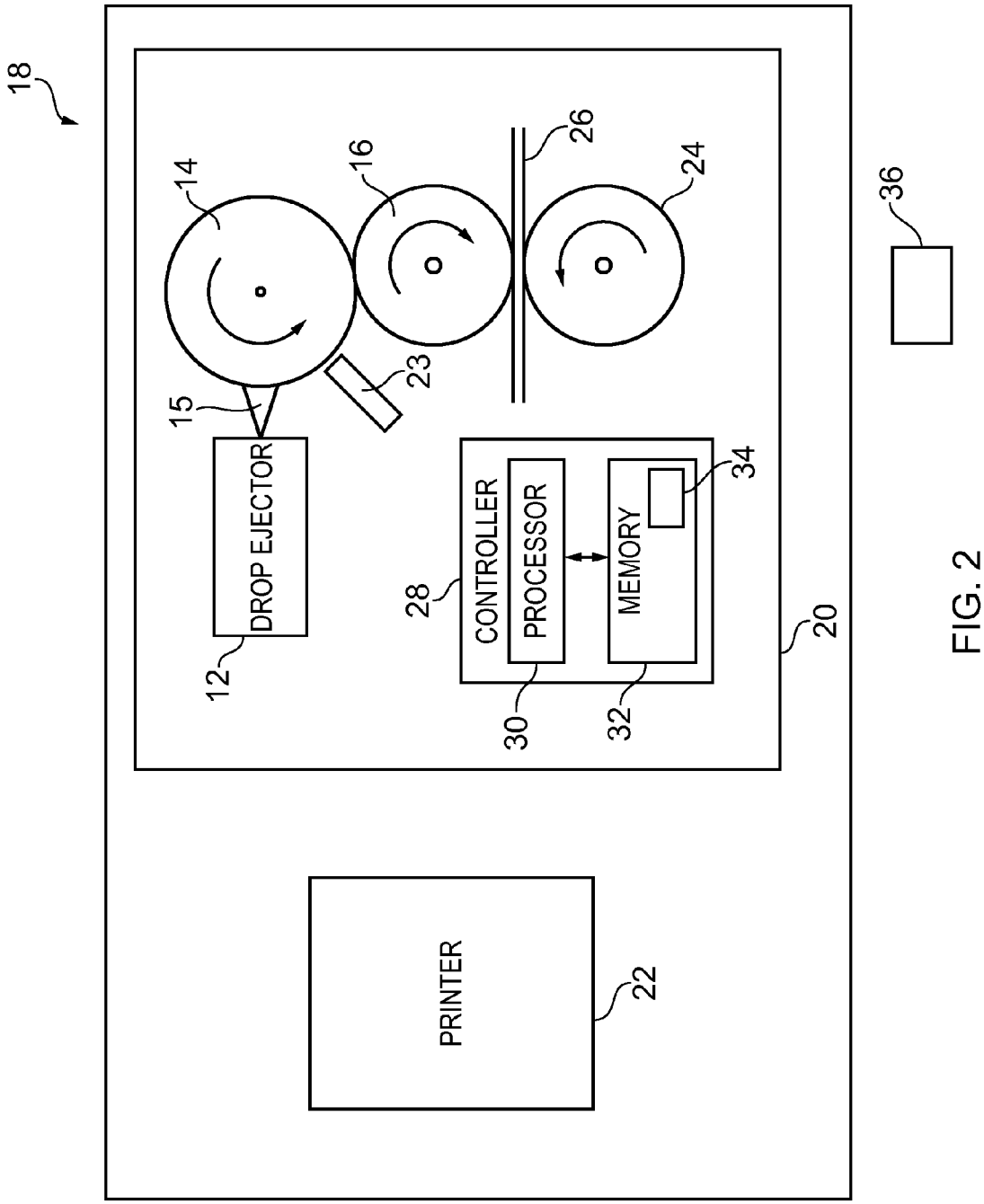

18
14
16
26
24
36
23
15
DROP EJECTOR
12
CONTROLLER
PROCESSOR
MEMORY
34
28
30
32
20
PRINTER
22

FIG. 2

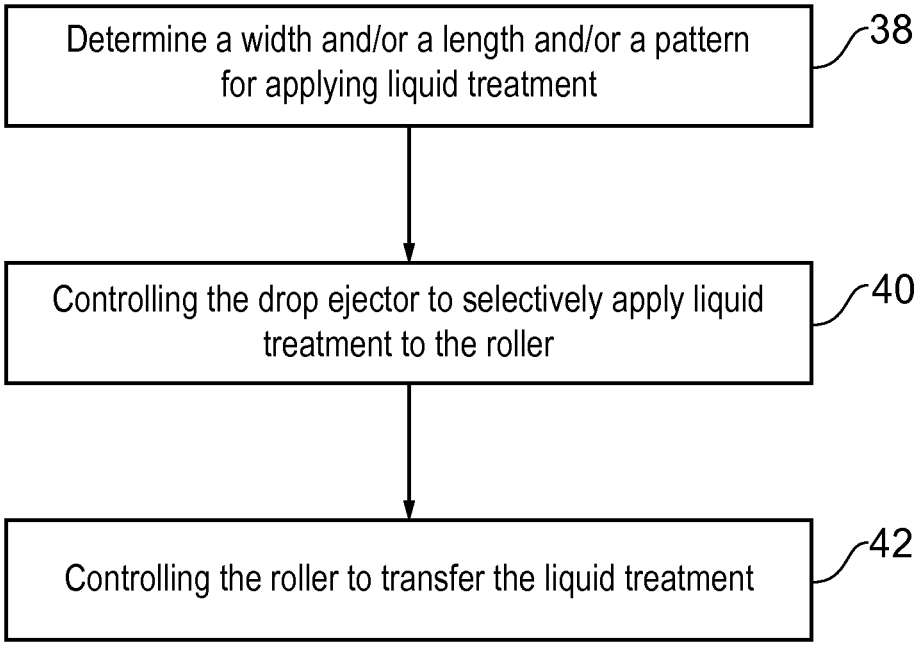

Determine a width and/or a length and/or a pattern for applying liquid treatment
38
Controlling the drop ejector to selectively apply liquid treatment to the roller
40
Controlling the roller to transfer the liquid treatment
42

FIG. 3

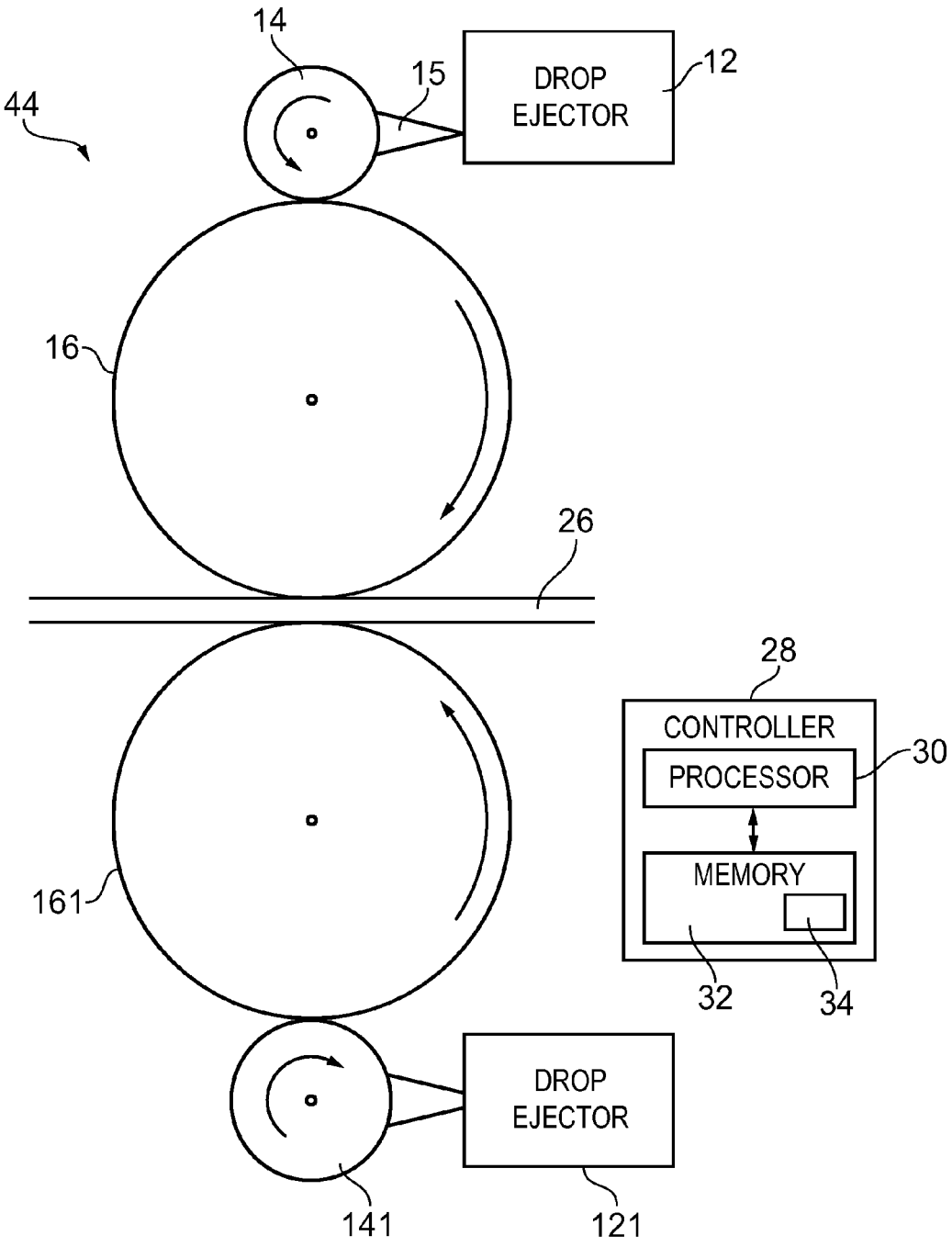

14
15
DROP EJECTOR
12
44
16
26
28
CONTROLLER
PROCESSOR
30
MEMORY
32
34
161
DROP EJECTOR
141
121

FIG. 4

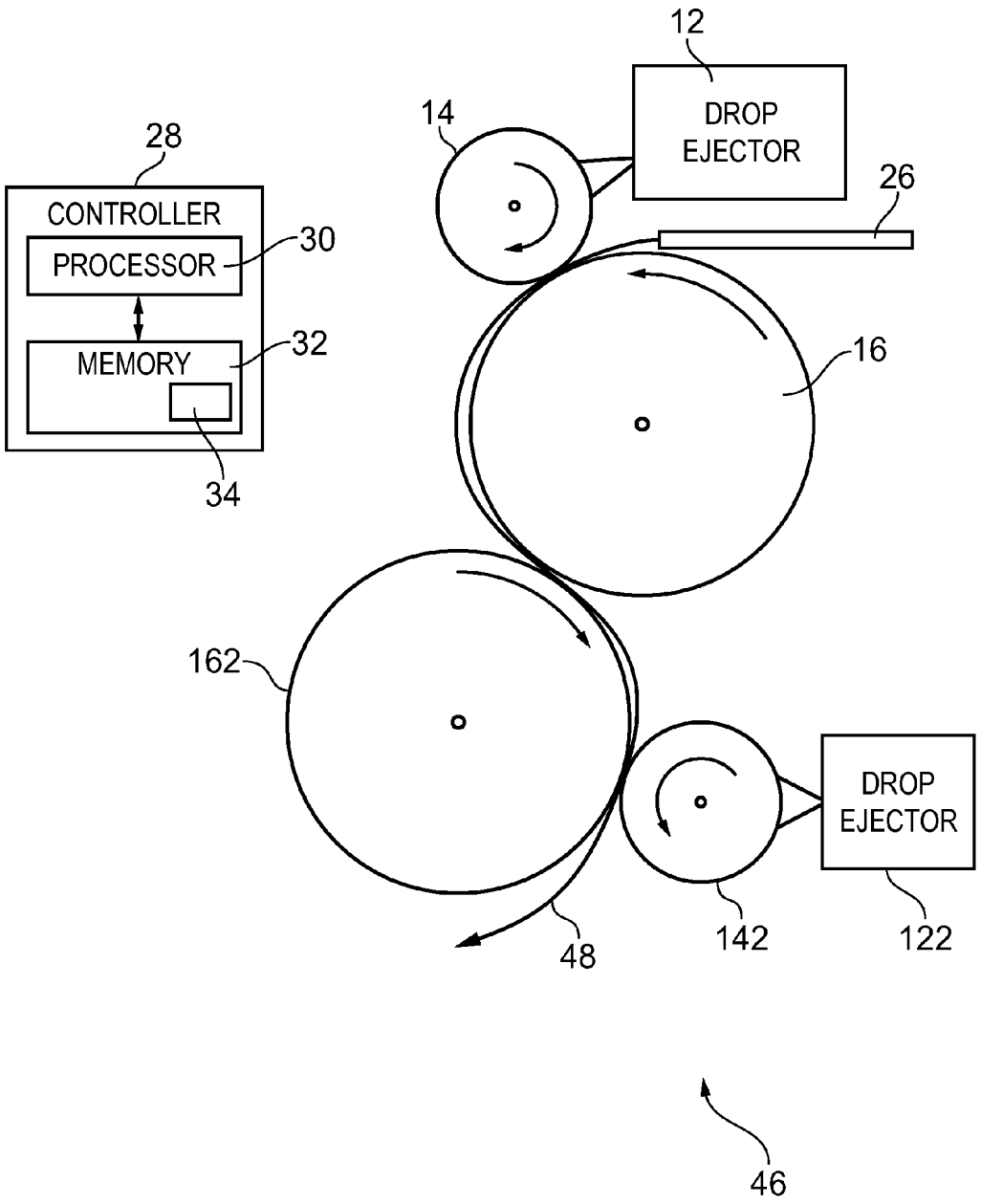

12
DROP EJECTOR
14
28
CONTROLLER
PROCESSOR
30
MEMORY
32
34
26
16
162
DROP EJECTOR
48
142
122
46

FIG. 5

MEDIA TREATMENT APPARATUS

BACKGROUND

Media treatment apparatus may be used to apply a layer of liquid treatment on media (such as paper) prior to or after the deposition of ink on the media. For example, media treatment apparatus may apply a pre-printing treatment (such as primer) to the media to improve the fixing of the ink to the media (and transferability of the ink from the intermediate transfer (ITM) drum) and thereby improve the quality of printed text and/or images on the substrate. By way of another example, media treatment apparatus may be used to apply a layer of post-printing treatment (such as varnish) on media after the deposition of ink on the media.

BRIEF DESCRIPTION

Reference will now be made by way of example only to the accompanying drawings in which:

FIG. **1** illustrates a schematic diagram of a media treatment apparatus according to an example;

FIG. **2** illustrates a schematic diagram of a printing apparatus including a printer and a media treatment apparatus according to an example;

FIG. **3** illustrates a flow diagram of a method of controlling media treatment apparatus according to an example;

FIG. **4** illustrates a schematic diagram of another media treatment apparatus according to an example; and

FIG. **5** illustrates a schematic diagram of a further media treatment apparatus according to an example.

DETAILED DESCRIPTION

FIG. **1** illustrates a schematic diagram of a media treatment apparatus **10** including a drop ejector **12** and a roller **14**. The media treatment apparatus **10** is arranged to apply liquid treatment **15** (such as primer or varnish) to media (such as paper, fabric, or plastic). The media treatment apparatus **10** may be an integral non-removable part of a printer apparatus that includes a printer. In another example, the media treatment apparatus **10** may be a removable part of a printer apparatus or may be standalone device that is not part of a printer apparatus. In some examples, the media treatment apparatus **10** is a module. As used here, the term 'module' refers to a unit or apparatus that excludes certain parts/components that would be added by an end manufacturer or a user. For example, a doctor blade may be added to the media treatment apparatus **10** to remove excess liquid treatment **15** from the roller **14**.

The drop ejector **12** may be any suitable device for applying liquid treatment **15** to the roller **14** and may comprise, for example, one or more inkjet printheads mounted on a moveable carriage, or may comprise one or more spray nozzles that are adjustable to provide a variable width of spray of liquid treatment **15**. The drop ejector **12** may be moved along the length of the roller **14** on a carriage bar, or a plurality of drop ejectors could be provided in a 'page-wide array' arrangement. The drop ejector **12** may include individually controllable segments that provide liquid treatment **15** or may include a plurality of individually controllable shutters that restrict or wholly prevent the spray of liquid treatment **15** from portions of the drop ejector **12**.

The roller **14** may be any suitable roller for receiving liquid treatment **15** from the drop ejector **12** and for transferring the liquid treatment **15** to an object **16**. For example, the roller **14** may be an anilox roller that has a core (comprising a metal such as steel or aluminium) which is coated by a material (such as a ceramic) having a surface that contains a plurality of cells for receiving the liquid treatment **15**. In other examples, the roller **14** may be a polyurethane roller, a metal roller or a rubber roller. The object **16** may be another roller (such as a roller having an outer surface comprising rubber) or may be a sheet or web of media.

The media treatment apparatus **10** provides an advantage in that by applying liquid treatment **15** to the roller **14** instead of directly to media, a relatively uniform layer of liquid treatment **15** may be applied to the media. Additionally, where the amount of liquid treatment **15** transferred to the media is reduced (for example, by increasing the speed of rotation of the roller **14** or by reducing the rate of spray from the drop ejector **12**), this may advantageously reduce the drying time for the applied liquid treatment and may improve the quality of the printed content on the media.

FIG. **2** illustrates a schematic diagram of printer apparatus **18** including a media treatment apparatus **20** and a printer **22**. The media treatment apparatus **20** is similar to the media treatment apparatus **10** illustrated in FIG. **1** and where the features are similar, the same reference numerals are used. The printer **22** may be any suitable printing device for applying ink to media to form text and/or images on the media. For example, the printer **22** may be an inkjet printer, a laser printer, an analogue offset printer, or a solid ink printer.

In some examples, media may first be provided to the media treatment apparatus **20** and then subsequently to the printer **22**. In these examples, the liquid treatment is a pre-printing treatment such as primer. In other examples, media may first be provided to the printer **22** and then subsequently to the media treatment apparatus **20**. In these examples, the liquid treatment is a post-printing treatment such as varnish.

The media treatment apparatus **20** includes a drop ejector **12**, a first roller **14** (e.g. an anilox roller), a second roller **16** (e.g. a rubber roller), a doctor blade **23**, an impression drum **24** and a controller **28**. The drop ejector **12**, the first roller **14**, the second roller **16** and the doctor blade **23** form an anilox device for applying liquid treatment to media. The controller **28** is arranged to control the operation of the anilox device as described in more detail in the following paragraphs.

The implementation of the controller **28** can be in hardware alone (for example, a circuit, a processor and so on), have certain aspects in software including firmware alone or can be a combination of hardware and software (including firmware).

The controller **28** may be implemented using instructions that enable hardware functionality, for example, by using executable computer program instructions in a general-purpose or special-purpose processor **30** that may be stored on a computer readable storage medium **32** (disk, memory etc) to be executed by such a processor **30**.

The processor **30** is configured to read from and write to the memory **32**. The processor **30** may also comprise an output interface via which data and/or commands are output by the processor **30** and an input interface via which data and/or commands are input to the processor **30**.

The memory **32** stores a computer program **34** comprising computer program instructions that control the operation of the media treatment apparatus **20** when loaded into the processor **30**. The computer program instructions **34** provide the logic and routines that enables the media treatment apparatus **20** to perform the methods illustrated in FIG. **3**.

The processor **30** by reading the memory **32** is able to load and execute the computer program **34**.

The computer program **34** may arrive at the media treatment apparatus **20** via any suitable delivery mechanism **36**. The delivery mechanism **36** may be, for example, a non-transitory computer-readable storage medium, a computer program product, a memory device, a record medium such as a compact disc read-only memory (CD-ROM) or digital versatile disc (DVD), an article of manufacture that tangibly embodies the computer program **34**. The delivery mechanism **36** may be a signal configured to reliably transfer the computer program **34**. The media treatment apparatus **20** may propagate or transmit the computer program **34** as a computer data signal.

Although the memory **32** is illustrated as a single component it may be implemented as one or more separate components some or all of which may be integrated/removable and/or may provide permanent/semi-permanent/dynamic/cached storage.

References to 'computer-readable storage medium', 'computer program product', 'tangibly embodied computer program' etc. or a 'controller', 'computer', 'processor' etc. should be understood to encompass not only computers having different architectures such as single/multi-processor architectures and sequential (Von Neumann)/parallel architectures but also specialized circuits such as field-programmable gate arrays (FPGA), application specific circuits (ASIC), signal processing devices and other processing circuitry. References to computer program, instructions, code etc. should be understood to encompass software for a programmable processor or firmware such as, for example, the programmable content of a hardware device whether instructions for a processor, or configuration settings for a fixed-function device, gate array or programmable logic device etc.

As used in this application, the term 'circuitry' refers to all of the following:

(a) hardware-only circuit implementations (such as implementations in only analogue and/or digital circuitry) and
(b) to combinations of circuits and software (and/or firmware), such as (as applicable): (i) to a combination of processor(s) or (ii) to portions of processor(s)/software (including digital signal processor(s)), software, and memory(ies) that work together to cause an apparatus to perform various functions) and
(c) to circuits, such as a microprocessor(s) or a portion of a microprocessor(s), that require software or firmware for operation, even if the software or firmware is not physically present.

This definition of 'circuitry' applies to all uses of this term in this application, including in any claims. As a further example, as used in this application, the term "circuitry" would also cover an implementation of merely a processor (or multiple processors) or portion of a processor and its (or their) accompanying software and/or firmware.

The controller **28** is arranged to control the operation of the drop ejector **12**, the first roller **14**, the second roller **16** and the impression drum **24**. Control lines from the controller **28** to these components are not illustrated in FIG. **2** to maintain the clarity of FIG. **2**.

In more detail, the controller **28** is arranged to control the first roller **14** to rotate in an anti-clockwise direction, control the second roller **16** to rotate in a clockwise direction and control the impression drum **24** to rotate in an anti-clockwise direction. The second roller **16** and the impression drum **24** form a nip through which media **26** travels through. Liquid treatment **15** is transferred from the drop ejector **12**, to the first roller **14**, to the second roller **16** and then to the media **26** as the media **26** travels through the nip formed between the second roller **16** and the impression drum **24**.

The doctor blade **23** is positioned adjacent the first roller **14** between the drop ejector **12** and the second roller **16** and is arranged to remove excess liquid treatment **15** from the first roller **14**. In some examples, the controller **28** may be arranged to control the position of the doctor blade **23** and move the doctor blade **23** towards and away from the first roller **14**. This may advantageously help to control the amount of excess liquid treatment **15** removed by the doctor blade **23**. The amount of liquid treatment **15** transferred to the media **26** may also be controlled by controlling the relative velocity of the first and second rollers **14** and **16**, controlling the distance of the drop ejector **12** to the first roller **14**, the flow rate to the drop ejector **12** and pressure in the jet of the drop ejector **12**.

The operation of the media treatment apparatus **20** is described in the following paragraphs with reference to FIGS. **2** and **3**.

At block **38**, the controller **28** determines a width and/or a length and/or a pattern for applying liquid treatment.

In some examples, the media treatment apparatus **20** and/or the printer apparatus **18** includes a sensor for sensing the dimensions of media **26** and provides the sensed dimensions to the controller **28**. The controller **28** analyses the sensed dimensions in the signal from the sensor and determines a width and/or a length for applying liquid treatment. The determined width and length for applying liquid treatment may be equal to, or less than, the sensed width and length of the media. The determined width may thus be less than the width of the roller **14**.

In other examples, the controller **28** determines the length and/or width for applying liquid treatment by analysing a user input signal that includes the dimensions of the media as specified by the user. For example, the user may input to the printer apparatus **18** that the media includes sheets of A4 paper and the controller **28** determines the length and/or width for applying liquid treatment to be equal to, or less than, the length and width of A4.

The controller **28** may determine the pattern for applying liquid treatment by analysing the content of information to be printed (or that has been printed) such that areas which include content receive liquid treatment, and areas which do not include content, do not receive liquid treatment.

At block **40**, the controller **28** controls the drop ejector **12** to selectively apply liquid treatment to the roller **14**. The controller **28** may use the width and/or length and/or pattern determined in block **38** to control the drop ejector **12** to apply liquid treatment to the roller **14**. For example, the pattern may be provided as a binary mask image defining those areas to receive and not receive liquid treatment and the controller **28** may use the binary mask image to control the drop ejector **12** to apply the pattern to the roller **14**.

The controller **28** may control the width over which the liquid treatment is applied by controlling the drop ejector **12** to provide liquid treatment while moving the drop ejector **12** parallel to the surface of the roller **14**. Where the drop ejector **12** sprays the liquid treatment in a cone or triangular shape, the controller **28** may also control the width over which the liquid treatment is applied by controlling the drop ejector **12** to provide liquid treatment while moving the drop ejector **12** perpendicular to the surface of the roller **14**. Where the drop ejector **12** includes an adjustable nozzle, the controller **28** may control the width over which the liquid treatment is applied by controlling the shape of the adjustable nozzle to provide a narrower or wider spray of liquid treatment.

Where the drop ejector **12** includes individually controllable segments, the controller **28** may control the width over which the liquid treatment is applied by controlling at least some of the segments to provide a narrower or wider spray of liquid treatment. Where the drop ejector **12** includes a plurality of controllable shutters, the controller **28** may control the width over which the liquid treatment is applied by controlling the shutters to restrict the spray of liquid treatment from the drop ejector **12** and thereby provide a narrower or wider spray of liquid treatment.

The controller **28** may control the length over which the liquid treatment is applied by controlling the drop ejector **12** to provide liquid treatment for a predetermined time period. Since the controller **28** may control the first roller **14** to rotate at a predetermined velocity, application of liquid treatment for the predetermined time period corresponds to liquid treatment being along the determined length. Where the drop ejector **12** includes an array of individually controllable segments, the controller **28** may control the length over which the liquid treatment is applied by controlling at least some of the segments to provide a shorter or longer spray of liquid treatment. Where the drop ejector **12** includes an array of controllable shutters, the controller **28** may control the length over which the liquid treatment is applied by controlling the shutters to restrict the spray of liquid treatment from the drop ejector **12** and thereby provide a shorter or longer spray of liquid treatment.

The controller **28** may control the pattern over which the liquid treatment is applied by controlling the position of the drop ejector **12** and the timing for applying the liquid treatment as described in the preceding paragraphs. By controlling the application of liquid treatment **15** over a predetermined width for a predetermined time or length, the controller **28** is able to control the drop ejector **12** to provide liquid treatment over particular areas of the media **26** (for example, over a photograph printed on the media **26**).

At block **42**, the controller **28** controls the first roller **14** to transfer the liquid treatment **15** from the first roller **14** to the second roller **16**.

In more detail, the controller **28** controls the first roller **14** to rotate in an anti-clockwise direction. As the first roller **14** rotates, excess liquid treatment **15** is removed from the first roller **14** by the doctor blade **23**, and the liquid treatment **15** is subsequently transferred from the first roller **14** to the second roller **16**. The controller **28** also controls the second roller **16** to rotate (in a clockwise direction) and rotates the liquid treatment into the nip between the second roller **16** and the impression drum **24** and transfers the liquid treatment **15** to the media **26**. The rotation of the second roller **16** and the impression drum **24** moves the media **26** through the media treatment apparatus **20** and toward the printer **22** (where the liquid treatment is primer) or toward an output tray (where the liquid treatment is varnish, or where the media treatment apparatus **20** is a standalone device).

The media treatment apparatus **20** provides an advantage in that liquid treatment is applied selectively to the media **26**. For example, the media treatment apparatus **20** may accurately provide liquid treatment to a sheet of media and within the margins of the media. If media having different dimensions is introduced to the media treatment apparatus **20**, the media treatment apparatus **20** may automatically determine the new dimensions and apply liquid treatment to fit the new dimensions. Consequently, the media treatment apparatus **20** may not require rollers to be replaced in order to provide liquid treatment to different dimensions of media.

The blocks illustrated in the FIG. **3** may represent steps in a method and/or sections of code in the computer program **34**. The illustration of a particular order to the blocks does not necessarily imply that there is a required or preferred order for the blocks and the order and arrangement of the blocks may be varied. Furthermore, it may be possible for some blocks to be omitted.

Although examples of the present invention have been described in the preceding paragraphs, it should be appreciated that modifications to the examples given can be made without departing from the scope of the invention as claimed. For example, the printer apparatus **18** may include a second media treatment apparatus in addition to the media treatment apparatus **20**. The media treatment apparatus **18** is arranged to apply one of a pre-treatment liquid and a post-treatment liquid to media, and the second media treatment apparatus is arranged to apply the other of the pre-treatment liquid and the post-treatment liquid to the media.

In FIG. **2**, the media treatment apparatus **20** is illustrated as being part of the printer apparatus **18**. However, in some examples, the media treatment apparatus **20** may not be part of a printer apparatus and may be a standalone device.

FIG. **4** illustrates a schematic diagram of another media treatment apparatus **44** according to an example. The media treatment apparatus **44** is similar to the media treatment apparatus **10** and **20** and where the features are similar, the same reference numerals are used. The media treatment apparatus **44** differs from the media treatment apparatus **20** in that it does not include an impression drum **24**, but instead includes a second drop ejector **121**, a third roller **141** and a fourth roller **161**. The media treatment apparatus **44** is a duplex apparatus since media **26** is fed between the second roller **16** and the fourth roller **161** and the second roller **16** is arranged to provide liquid treatment to the top surface of the media **26**, and the fourth roller **161** is arranged to provide liquid treatment to the bottom surface of the media **26**.

The controller **28** is arranged to control the operation of the second drop ejector **121**, the third roller **141** and the fourth roller **161** as described above with reference to FIGS. **2** and **3**. That is, the controller **28** is arranged to control the second drop ejector **121**, the third roller **141** and the fourth roller **161** so that a desired width and/or length and/or pattern of liquid treatment is transferred to the bottom surface of the media **26**.

FIG. **5** illustrates a schematic diagram of a further media treatment apparatus **46** according to an example. The media treatment apparatus **46** is similar to the media treatment apparatus **10** and **20** and where the features are similar, the same reference numerals are used. The media treatment apparatus **46** differs from the media treatment apparatus **20** in that it does not include an impression drum **24**, but instead includes a second drop ejector **122**, a third roller **142** and a fourth roller **162**. The media treatment apparatus **44** is an in-line duplex apparatus since media **26** is fed between the first roller **14** and the second roller **16** and follows the path indicated by reference numeral **48** (that is, the media **26** is fed between the first roller **14** and the second roller **16** and then moves between the third roller **142** and the fourth roller **162**). The first roller **14** is arranged to provide liquid treatment to the top surface of the media **26**, and the third roller **142** is arranged to provide liquid treatment to the bottom surface of the media **26**.

The controller **28** is arranged to control the operation of the second drop ejector **122**, the third roller **142** and the fourth roller **162** as described above with reference to FIGS. **2** and **3**. That is, the controller **28** is arranged to control the second drop ejector **122**, the third roller **142** and the fourth

roller **162** so that a desired width and/or length and/or pattern of liquid treatment is transferred to the bottom surface of the media **26**.

Features described in the preceding description may be used in combinations other than the combinations explicitly described.

Although functions have been described with reference to certain features, those functions may be performable by other features whether described or not.

Although features have been described with reference to certain examples, those features may also be present in other examples whether described or not.

Whilst endeavoring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

I claim:

1. Media treatment apparatus to apply liquid treatment to media, the media treatment apparatus comprising:

a roller to receive liquid treatment and to transfer the liquid treatment;

a drop ejector to apply liquid treatment to the roller to transfer liquid treatment to the media;

a controller to control the drop ejector to selectively apply liquid treatment to the roller;

wherein the controller is arranged to determine a pattern for applying liquid treatment based on information for printing to the media, and to control the drop ejector to apply liquid treatment to the roller according to the determined pattern, and

a second roller to receive the liquid treatment from a second drop ejector so as to apply the liquid treatment to the media, the roller and ejector being disposed to apply the liquid treatment to an opposite side of the media from the second roller and second drop ejector.

2. Media treatment apparatus as claimed in claim **1**, wherein the roller comprises an anilox roller.

3. Media treatment apparatus as claimed in claim **1**, wherein the liquid treatment is a primer or a varnish.

4. Media treatment apparatus as claimed in claim **1**, further comprising another roller to receive liquid treatment from the roller and to apply the liquid treatment to the media.

5. Media treatment apparatus as claimed in claim **1**, wherein the controller is arranged to determine the pattern for applying liquid treatment by analysing the content of the information for printing to the media, wherein liquid treatment is applied to areas that include content and not applied to areas that do not include content.

6. Media treatment apparatus as claimed in claim **1**, wherein:

the drop ejector is a sprayer that sprays the liquid treatment in a cone or triangular shape; and

the controller is arranged to determine a width for applying liquid treatment, the determined width being less than the width of the roller and media, and to control the drop ejector to apply liquid treatment to the roller along the determined width.

7. Media treatment apparatus as claimed in claim **1**, wherein:

the drop ejector is a sprayer that sprays the liquid treatment in a cone or triangular shape; and

the controller is arranged to determine a length for applying liquid treatment, and to control the drop ejector to apply liquid treatment to the roller for the determined length.

8. Media treatment apparatus as claimed in claim **1**, wherein the drop ejector comprises a sprayer and a plurality of individually controlled shutters to selectively restrict a spray of the liquid treatment.

9. Media treatment apparatus as claimed in claim **1**, further comprising a doctor blade adjacent the roller to remove excess liquid treatment from the roller.

10. Media treatment apparatus as claimed in claim **9**, the controller to selectively control a distance between the doctor blade and the roller based on an amount of excess liquid treatment that should be removed.

11. Media treatment apparatus as claimed in claim **1**, the controller to selectively adjust a velocity of the roller based on an amount of liquid treatment that should be applied.

12. Media treatment apparatus as claimed in claim **1**, the controller to, based on an amount of liquid treatment that should be applied, selectively adjust any of: (1) a distance between the drop ejector and the roller, (2) a flow rate of the drop ejector, and (3) a pressure of fluid from the drop ejector.

13. Media treatment apparatus as claimed in claim **1**, further comprising a sensor for sending dimensions of the media, the controller to determine the pattern for applying liquid treatment based on output from the sensor.

14. Media treatment apparatus as claimed in claim **1**, the controller to determine the pattern for applying liquid treatment based on a user input signal indicating dimensions of the media.

15. A method of controlling media treatment apparatus, the method comprising:

determining a pattern for applying liquid treatment based on information for printing to an object;

controlling a drop ejector and a second drop ejector to selectively apply liquid treatment to a roller and a second roller according to the determined pattern; and

controlling the roller and the second roller to transfer the liquid treatment to the object and to an opposite side of the object, respectively.

16. A method as claimed in claim **15**, further comprising analysing the content of the information for printing to the object to determine the pattern for applying liquid treatment, wherein liquid treatment is applied to areas that include content and not applied to areas that do not include content.

17. A method as claimed in claim **15**, further comprising:

determining a width for applying liquid treatment, the determined width being less than the width of the roller; and

controlling the drop ejector to apply liquid treatment to the roller along the determined width.

18. A method as claimed in claim **15**, further comprising:

determining a length for applying liquid treatment; and

controlling the drop ejector to apply liquid treatment to the roller for the determined length.

19. A non-transitory computer-readable storage medium encoded with instructions that, when performed by a processor, cause performance of a method according to claim **15**.

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